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CSCI 3104, Algorithms **Profs. Chen & Grochow**

Exam 2 – S12 **Spring 2020, CU-Boulder**

Instructions: This quiz is open book and open note. You **may** post clarification questions to Piazza, with the understanding that you may not receive an answer in time and posting does count towards your time limit (30 min for 1x, 37.5 min for 1.5x, 45 min for 2x). Questions posted to Piazza **must be posted as PRIVATE QUESTIONS.** Other use of the internet, including searching for answers or posting to sites like Chegg, is strictly prohibited. Violations of these are grounds to receive a 0 on this quiz. Proofs should be written in **complete sentences. Show and justify all work to receive full credit.**

YOU MUST SIGN THE HONOR PLEDGE. Your quiz will otherwise not be graded. Honor Pledge: On my honor, I have not used any outside resources (other than my notes and book), nor have I given any help to anyone completing this assignment.

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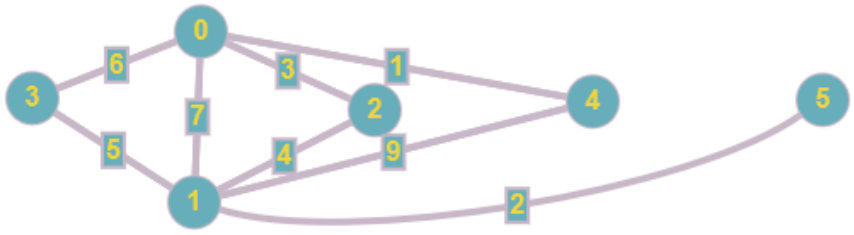
Standard 12. Consider the following graph G.



(a) Determine all the edges of G which do not belong to any MST. Clearly justify your answer.

Using the Cycle Property, we can tell which edges do not belong to any MST. If an edge e is the heaviest in a cycle c, then it does not belong in any MST.
Edge (0, 1) does not belong in any MST because it is the heaviest edge in the cycle 013.
Edge (1, 4) does not belong in any MST because it is the heaviest edge in the cycle 014.
Edge (0, 3) does not belong in any MST because it is the heaviest edge in the cycle 0213.

(b) Determine all edges of G which belong to every MST. Clearly justify your answer.

Using the Cut Property, we can tell which edges must belong to every MST. If and edge e is the lightest in a cycle c, then it belongs to every MST.
Edge (1, 3) because it belongs to the cut (0, 3), (1, 3).
Edge (0, 2) because it belongs to the cut (0, 2), (1, 2).
Edge (0, 4) because it belongs to the cut (0, 4), (1, 4).
Edge (1, 5) because it is itself is a cut edge of G.
Edge (1, 2) because it belongs to the cut (1, 2), (0, 1), (1, 3).